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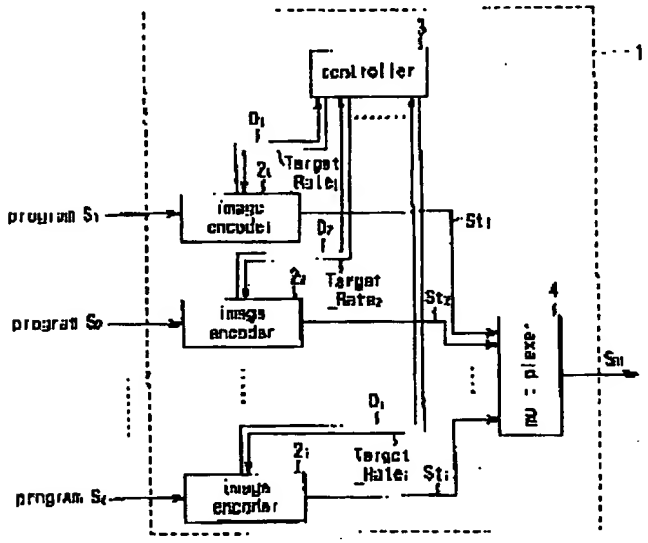
(54) **DISPOSITIF ET PROCEDE DE COMMANDE DE CODAGE D'IMAGES, SYSTEME DE CODAGE, SYSTEME DE TRANSMISSION ET SYSTEME DE DIFFUSION**

(54) **DEVICE AND METHOD FOR CONTROLLING IMAGE ENCODING, ENCODING SYSTEM, TRANSMISSION SYSTEM AND BROADCAST SYSTEM**



(57) L'invention porte sur un dispositif de commande de codage d'images, ainsi que sur les débits de code cibles appropriés aux données de programme respectives pouvant être attribuées au moyen d'une technique de multiplexage statistique. Un contrôleur (3) reçoit des

(57) A device for controlling image encoding, with which target code rates suitable for respective program data can be allocated by using a statistical multiplex technique. A controller (3) receives the encoding difficulties (D_i) of programs from image encoders (2_i)

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ABSTRACT

The present invention employs a statistical multiplexing method to enable suitable assignment of a target code rate to each program data. A controller (3) acquires encoding difficulty (Di) of each program from each of image encoders (2i). In accordance with an equation for transforming the encoding difficulty (Di) into a bit rate, the controller (3) calculates a temporary bit rate (Tmp_Ratei). Moreover, the controller (3) causes the sum of the target bit rates (Target_Ratei) to satisfy a predetermined allowable value by correcting the temporary bit rate (Tmp_Ratei) so as to determine a final target bit rate (Target_Ratei) and inputing the final target bit rate (Target_Ratei) to each of the image encoders (2i).

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WHAT IS CLAIMED IS:

1. A device for controlling image encoding for use in a system provided with a plurality of encoding means for encoding a plurality of program data, each including image data, and multiplexing means for multiplexing output data of each of the encoding means, said image encoding control apparatus controlling each of the encoding means by setting a target code rate to each of the encoding means as a target amount of codes to be generated per unit time, and comprising:

a temporary target-code-rate determining means for acquiring encoding difficulty which indicates difficulty in encoding for each program data, and for determining a temporary target code rate for each program data which corresponds to the acquired encoding difficulty for each program data by using a corresponding relationship between the encoding difficulty and a target code rate set for each program data; and

a target-code-rate correcting means for correcting the temporary target code rate determined by the temporary target-code-rate determining means in such a manner that the sum of the target code rates for each program data is within a specific allowable value range so as to determine a final target code rate for each program data, and for setting the final target rate to each of the encoding means.

2. A device for controlling image encoding according to claim 1 wherein the corresponding relationship between the encoding difficulty and the target code rate which is used in the temporary target-code-rate determining means is set in accordance with a maximum value, a minimum

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value and an average value of the target code rate predetermined for each program data and an average value of the encoding difficulty for each program data.

3. A device for controlling image encoding according to claim 1 wherein the corresponding relationship between the encoding difficulty and the target code rate which is used in the temporary target-code-rate determining means is set in such a manner that the larger the encoding difficulty is, the larger the target code rate becomes, and that in a specific range in which the encoding difficulty is larger than an average value of the encoding difficulty, a target code rate corresponding to the same encoding difficulty is lowered as compared with a case in which the encoding difficulty and the target code rate have a proportional relationship, whereas in a specific range in which the encoding difficulty is smaller than the average value of the encoding difficulty, the target code rate corresponding to the same encoding difficulty is raised as compared with a case in which the encoding difficulty and the target code rate have a proportional relationship.

4. A device for controlling image encoding according to claim 1 wherein the corresponding relationship between the encoding difficulty and the target code rate which is used in the temporary target-code-rate determining means is set in such a manner that the larger the encoding difficulty is, the larger the target code rate becomes, and that in a specific range in which the encoding difficulty is larger than an average value of the encoding difficulty, the larger the encoding difficulty is, the smaller the gradient of change in the target code rate corresponding to change in the

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encoding difficulty becomes.

5. A device for controlling image encoding according to claim 1 wherein the temporary target-code-rate determining means updates the corresponding relationship between the encoding difficulty and the target code rate whenever necessary based upon the acquired encoding difficulty in such a manner that an average value of the temporary target code rates which are determined by the temporary target-code-rate determining means approaches a predetermined average value of target code rates.

6. A device for controlling image encoding according to claim 1 wherein the target code rate correcting means multiplies the temporary target code rate for each program data with the ratio of the sum of the temporary target code rates for each of the program data to the allowable value during a process for determining the final target code rate for each program data.

7. A device for controlling image encoding according to claim 6 wherein the target code rate correcting means determines, regarding each program data having a value obtained by multiplying the temporary target code rate for each program data with said ratio deviating from a maximum value or a minimum value of a target code rate predetermined for each program data, the maximum value or the minimum value of the target code rate as the final target code rate, and corrects, regarding the remaining program data, the temporary target code rate in such a manner that the sum of the target code rates of the remaining program data is within a value obtained by subtracting the determined target code rate from the allowable

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changed is in a code rate which can be assigned to the encoding means having the target code rate which can be changed, when the sum of the target code rates for the encoding means having the target code rate which can be changed is higher than the code rate which can be assigned to the encoding means having the target code rate which can be changed.

10. A method for controlling image encoding for use in a system provided with a plurality of encoding means for encoding a plurality of program data, each including image data, and multiplexing means for multiplexing output data of each of the encoding means, in which a target code rate is set to each of the encoding means as a target amount of codes to be generated per unit time so as to control each of the encoding means, said image encoding control method including:

a temporary target-code-rate determining step for acquiring encoding difficulty which indicates encoding difficulty in encoding for each program data, and for determining a temporary target code rate for each program data which corresponds to the acquired encoding difficulty for each program data by using a corresponding relationship between the encoding difficulty and a target code rate set for each program data; and

a target-code-rate correcting step for correcting the temporary target code rate determined in the temporary target code rate determining step in such a manner that the sum of target code rates for each program data is within a specific allowable value range so as to determine a final target code rate for each program data, and for setting the final target code rate to each of the encoding means.

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11. A method for controlling image encoding according to claim 10 wherein the corresponding relationship between the encoding difficulty and the target code rate which is used in the temporary target-code-rate determining step is set in accordance with a maximum value, a minimum value and an average value of the target code rate determined for each program data and an average value of the encoding difficulty for each program data.

12. A method for controlling image encoding according to claim 10 wherein the corresponding relationship between the encoding difficulty and the target code rate which is used in the temporary target-code-rate determining step is set in such a manner that the larger the encoding difficulty is, the larger the target code rate becomes, and that in a specific range in which the encoding difficulty is larger than an average value of the encoding difficulty, a target code rate corresponding to the same encoding difficulty is lowered as compared with a case in which the encoding difficulty and the target code rate have a proportional relationship, whereas in a specific range in which the encoding difficulty is smaller than the average value of the encoding difficulty, the target code rate corresponding to the same encoding difficulty is raised as compared with a case in which the encoding difficulty and the target code rate have a proportional relationship.

13. A method for controlling image encoding according to claim 10 wherein the corresponding relationship between the encoding difficulty and the target code rate which is used in the temporary target-code-rate determining step is set in such a manner that the larger the encoding

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difficulty is, the larger the target code rate becomes, and that in a specific range in which the encoding difficulty is larger than an average value of the encoding difficulty, the larger the encoding difficulty is, the smaller the gradient of change in the target code rate corresponding to change in the encoding difficulty becomes.

14. A method for controlling image encoding according to claim 10 wherein the temporary target-code-rate determining step updates the corresponding relationship between the encoding difficulty and the target code rate whenever necessary based upon the acquired encoding difficulty in such a manner that an average value of the temporary target code rates which are determined in the temporary target-code-rate determining step approaches a predetermined average value of target code rates.

15. A method for controlling image encoding according to claim 10 wherein the target code rate correcting step multiplies the temporary target code rate for each program data with the ratio of the sum of the temporary target code rates for each program data to the allowable value during a process for determining the final target code rate for each program data.

16. A method for controlling image encoding according to claim 15 wherein the target code rate correcting step determines, regarding each program data having a value obtained by multiplying the temporary target code rate for each program data with said ratio deviating from a maximum value or a minimum value of a target code rate predetermined for each program data, the maximum value or the minimum value of the target code rate as the final target code rate, and corrects, regarding the remaining

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program data, the temporary target code rate in such a manner that the sum of the target code rates of the remaining program data is within a value obtained by subtracting the determined target code rate from the allowable value so as to determine the final target code rate.

17. A method for controlling image encoding according to claim 10 wherein:

each of the encoding means is able to change the target code rate for each of a plurality of images,

the temporary target-code-rate determining step determines the temporary target code rate for each image units, and

the target-code-rate correcting step determines the final target code rate by correcting the temporary target code rate determined in the temporary target-code-rate determining step for only encoding means having the target code rate which can be changed in such a manner that the sum of the target code rates for the respective program data is within a specific allowable value, and sets the final target code rate to the encoding means.

18. A method for controlling image encoding according to claim 17 wherein the target code rate correcting step determines the temporary target code rate as it is as the final target code rate for the encoding means having the target code rate which can be changed when the sum of the temporary target code rates of the encoding means having the target code rate which can be changed is equal to or lower than the code rate which can be assigned to the encoding means having the target code rate which can be changed, and, determines the final target code rate by correcting the temporary target code

rate for the encoding means having the target code rate which can be changed in such a manner that the sum of the final target code rates of the encoding means having the target code rate which can be changed is in a code rate which can be assigned to the encoding means having the target code rate which can be changed, when the sum of the target code rates for the encoding means having the target code rate which can be changed is higher than the code rate which can be assigned to the encoding means having the target code rate which can be changed.

19. An encoding system for encoding a plurality of program data each of which includes image data to multiplex encoded program data, the encoding system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means each of which codes image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by the encoding means; and

control means for calculating a target code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means, based upon an equation individually set for each program data and applied for calculating the target code rate from the encoding difficulty, for inputting the calculated target code rate to each encoding

means.

20. An encoding system according to claim 19 wherein the equation is determined based upon an average value of the encoding difficulty for each program data.

21. An encoding system according to claim 20 wherein the average value of the encoding difficulty is updated in accordance with a result of encoding.

22. An encoding system according to claim 19 wherein the equation defines a maximum value and a minimum value of the target code rate for each program data.

23. An encoding system for encoding a plurality of program data each of which includes image data to multiplex encoded program data, the encoding system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means each of which codes image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by the encoding means; and

control means for calculating a target code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means in accordance with an equation determined, based upon an

average value of the target code rate previously determined for each program data, individually set for each program data and applied for calculating the target code rate from the encoding difficulty, and inputting the calculated target code rate to each encoding means.

24. An encoding system according to claim 23 wherein the equation is determined based upon an average value of the encoding difficulty for each program data.

25. An encoding system according to claim 24 wherein the average value of the encoding difficulty is updated in accordance with a result of encoding.

26. An encoding system according to claim 23 wherein the equation defines a maximum value and a minimum value of the target code rate for each program data.

27. An encoding system for encoding a plurality of program data each of which includes image data to multiplex encoded program data, the encoding system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means each of which codes image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by the encoding means; and

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control means for calculating, for each program data, a temporary code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means, calculating a target code rate for each program from the temporary target code rate in such a manner that the sum of the temporary target code rates calculated for each program data is wiithin a specific allowable range and inputting the calculated target code rate to each encoding means for each program data.

28. An encoding system according to claim 27 wherein the control means calculates the temporary target code rate for each program data from the encoding difficulty detected by each of the encoding difficulty detecting means based upon an equation individually set for each program data and applied for calculating the temporary target code rate from the encoding difficulty.

29. An encoding system according to claim 28 wherein the equation is determined based upon an average value of the target code rate previously determined for each program data.

30. An encoding system according to claim 28 wherein the equation is determined based upon an average value of the encoding difficulty for each program data.

31. An encoding system according to claim 30 wherein the average value of the encoding difficulty is updated in accordance with a result of encoding.

32. An encoding system according to claim 28 wherein the equation defines a maximum value and a minimum value of the target code rate for

each program data.

33. An encoding system for encoding a plurality of program data each of which includes image data to multiplex encoded program data, the encoding system comprising:

a plurality of encoding difficulty detecting means for detecting, for each encoding program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means each of which codes image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by the encoding means; and

control means for calculating a temporary code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means regardless of the encoding difficulty in other program data, calculating a target code rate for each program from the temporary target code rate in such a manner that the sum of the temporary target code rates calculated for each program data is within a specific allowable range and inputting the calculated target code rate to each encoding means for each program data.

34. A coding system according to claim 33 wherein the control means calculates the temporary target code rate for each program data from the encoding difficulty detected by each of the encoding difficulty detecting

means in accordance with an equation individually set for each program data and applied for calculating the temporary target code rate from the encoding difficulty.

35. An encoding system according to claim 34 wherein the equation is determined based upon an average value of the target code rate previously determined for each program data.

36. An encoding system according to claim 34 wherein the equation is determined based upon an average value of the encoding difficulty for each program data.

37. An encoding system according to claim 36 wherein the average value of the encoding difficulty is updated in accordance with a result of encoding.

38. An encoding system according to claim 34 wherein the equation defines a maximum value and a minimum value of the target code rate for each program data.

39. An encoding system for encoding a plurality of program data each of which includes image data to multiplex encoded program data, the encoding system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means each of which codes image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

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multiplexing means for multiplexing data encoded by the encoding means; and

control means for calculating, for each program data, a temporary code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means, based upon an equation for calculating a temporary target code rate from the encoding difficulty, which is individually set for each program data and which is not affected by the encoding difficulty of the other program data, calculating a target code rate for each program data from the temporary target code rate in such a manner that the sum of the temporary target code rates calculated for each program data is within a specific allowable range, and inputting the calculated target code rate to each encoding means.

40. An encoding system according to claim 39 wherein the equation is determined based upon an average value of the target code rate previously determined for each program data.

41. An encoding system according to claim 39 wherein the equation is determined based upon an average value of the encoding difficulty for each program data.

42. An encoding system according to claim 41 wherein the average value of the encoding difficulty is updated in accordance with a result of encoding.

43. An encoding system according to claim 39 wherein the equation defines a maximum value and a minimum value of the target code rate for each program data.

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44. A transmission system for encoding a plurality of program data each of which includes image data, multiplexing encoded program data and transmitting, as transmission data, encoded data, the transmission system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means for encoding image data included in each program data in accordance with a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by each encoding means to transmit multiplexed data as transmission data; and

control means for calculating a target code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means, based upon an equation individually set to each program data and applied for calculating the target code rate from the encoding difficulty, and inputting the calculated target code rate to each encoding means.

45. A transmission system for encoding a plurality of program data each of which includes image data, multiplexing encoded program data and transmitting, as transmission data, encoded data, the transmission system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in

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encoding when image data included in each program data is encoded;

a plurality of encoding means for encoding image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by each encoding means to transmit multiplexed data as transmission data; and

control means for calculating a target code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means, based upon an equation determined in accordance with an average value of the target code rate previously determined for each program data, individually set to each program data and applied for calculating the target code rate from the encoding difficulty, and inputting the calculated target code rate to each encoding means.

46. A transmission system for encoding a plurality of program data each of which includes image data, multiplexing encoded program data and transmitting, as transmission data, encoded data, the transmission system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means for encoding image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by each encoding

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code rate in such a manner that the sum of the temporary target code rates calculated for each program data is in a specific allowable range and inputing the calculated target code rate to each encoding means for each program data.

48. A transmission system for encoding a plurality of program data each of which includes image data, multiplexing encoded program data and transmitting, as transmission data, encoded data, the transmission system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means for encoding image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by each encoding means to transmit multiplexed data as transmission data; and

control means for calculating a temporary code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means, based upon an equation for calculating a temporary target code rate from the encoding difficulty, which is individually set for each program data and which is not affected by the encoding difficulty of the other program data, calculating a target code rate for each program from the temporary target code rate in such a manner that the sum of the temporary target code rates calculated for each program data is in a specific allowable

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range and inputting the calculated target code rate to each encoding means.

49. A broadcast system for encoding a plurality of program data each of which includes image data, multiplexing encoded data and transmitting, as broadcast data, encoded data, the broadcast system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means for encoding image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by each encoding means to transmit multiplexed data as broadcast data; and

control means for calculating a target code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means based upon an equation individually set to each program data and applied for calculating the target code rate from the encoding difficulty and inputting the calculated target code rate to each encoding means.

50. A broadcast system for encoding a plurality of program data each of which includes image data, multiplexing encoded data and transmitting, as broadcast data, encoded data, the broadcast system comprising:

a plurality of encoding difficulty detecting means for detecting, for

each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means for encoding image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by each encoding means to transmit multiplexed data as broadcast data; and

control means for calculating a target code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means based upon an equation determined in accordance with an average value of the target code rate previously determined for each program data, individually set to each program data and applied for calculating the target code rate from the encoding difficulty and inputing the calculated target code rate to each encoding means.

51. A broadcast system for encoding a plurality of program data each of which includes image data, multiplexing encoded data and transmitting, as broadcast data, encoded data, the broadcast system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means for encoding image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

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multiplexing means for multiplexing data encoded by each encoding means to transmit multiplexed data as broadcast data; and

control means for calculating a temporary code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means, calculating a target code rate for each program from the temporary target code rate in such a manner that the sum of the temporary target code rates calculated for each program data is in a specific allowable range and inputting the calculated target code rate to each encoding means for each program data.

52. A broadcast system for encoding a plurality of program data each of which includes image data, multiplexing encoded data and transmitting, as broadcast data, encoded data, the broadcast system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means for encoding image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by each encoding means to transmit multiplexed data as broadcast data; and

control means for calculating a temporary code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means regardless of the encoding difficulty in other program data,

calculating a target code rate for each program from the temporary target code rate in such a manner that the sum of the temporary target code rates calculated for each program data is within a specific allowable range and inputting the calculated target code rate to each encoding means for each program data.

53. A broadcast system for encoding a plurality of program data each of which includes image data, multiplexing encoded data and transmitting, as broadcast data, encoded data, the broadcast system comprising:

a plurality of encoding difficulty detecting means for detecting, for each program data, encoding difficulty indicating encoding difficulty in encoding when image data included in each program data is encoded;

a plurality of encoding means for encoding image data included in each program data based upon a input target code rate which is a target amount of codes which must be generated per unit time;

multiplexing means for multiplexing data encoded by each encoding means to transmit multiplexed data as broadcast data; and

control means for calculating a temporary code rate for each program data from the encoding difficulty detected by the encoding difficulty detecting means, based upon an equation for calculating a temporary target code rate from the encoding difficulty, which is individually set for each program data and which is not affected by the encoding difficulty of the other program data, calculating a target code rate for each program from the temporary target code rate in such a manner that the sum of the temporary